[001] TRANSMISSION WITH DIRECT GEAR

[002]

[003]

[004] The present invention relates to a transmission for a motor vehicle comprising an input shaft, an output shaft, and at least one countershaft, wherein the transmission comprises at least one direct gear, pursuant to the preamble of patent claim 1.

[005]

[006] According to the state of the art, for the purpose of minimizing fuel consumption, powertrains for motor vehicles are frequently designed such that the main drive parts are driven in the direct gear. In the direct gear, the power flow occurs by way of direct coupling of the input shaft with the output shaft, which results in an increase in the degree of efficiency. By contrast, in the additional non-direct gears further losses develop, for example, due to gear meshing under load, dynamic anti-friction bearing load and pump power.

[007] In transmissions in the direct gear, according to the state of the art, the power-conducting parts required for the remaining gears are not entirely uncoupled as is the case, for example, in the transmission of DE 198 31 293 A1 of the Applicant. Due to the fact that the countershafts are driven via a drive constant, the shafts, wheels, bearings, synchronizing parts, etc., each rotate along at the speed specified by the drive constant, although these parts are not involved in the power transmission process.

[008] Due to the resulting friction, which also develops in the unloaded state, the degree of efficiency of the transmission deteriorates. The friction can be caused through churning losses caused by the immersion of the gear wheels in the oil pan or by friction losses on the synchronizations and on the bearings.

[009] DE 41 17 642 A1 describes a multi-shaft transmission with several gear in which at least one gear is formed by a gear set, wherein the gear wheels of the gear set are rotatably seated on corresponding shafts and mesh on a continuous basis, and wherein each shaft comprises a clutch or synchronizing device in order

to complete or interrupt the torque transmission path via the clutch. This way the gear wheels of the gear set can be isolated from the input and output so that the total inertia mass of the rotating gear parts is reduced. This design has the disadvantage that by using two synchronizing devices for one gear set the manufacturing and maintenance costs are negatively impacted.

[010] It is the objective of the present invention to provide a transmission comprising an input shaft, an output shaft and at least one countershaft, which avoids the disadvantages of the state of the art and exhibits an optimized degree of efficiency in the direct gear.

[011] This objective is solved by the features of patent claim 1. Additional embodiments and advantages are disclosed in the dependent claims.

[012]

[013] A transmission for a motor vehicle is suggested, comprising an input shaft, an output shaft and at least one countershaft, wherein the transmission comprises at least one direct gear and wherein the parts that are not involved in the power flow in the direct gear are completely or partially uncoupled when the direct gear is engaged.

[014] A particularly beneficial embodiment of the present invention provides that only the input and output shafts and their internal connecting elements rotate in the direct gear.

[015] Within the framework of another embodiment of the present invention, it is suggested in the case of transmissions with a drive constant to design the gearing arranged on the input shaft such that it can be engaged or disengaged using a shift element so that, e.g., the countershaft does not rotate too.

[016] In transmissions comprising two drive constants, according to the invention, the shift collar between the drive constants is shifted to "neutral".

[017] Another variation of the design, according to the invention, provides that the input and output shafts can be connected directly via a connecting element without using a gear wheel as the connecting element.

[018] The principle presented here can be used in transmissions with a downstream group for the main transmission, both in directly and in indirectly shifted downstream groups. Additionally, it is possible in transmissions with a downstream group to apply the inventive design also for the downstream group. Here the input is connected directly to the output of the downstream group; the remaining parts that are not involved in the power flow are uncoupled according to the invention. Furthermore, the invention can be applied for both single and multiple countershaft transmissions.

[019]

[020] The invention is explained in more detail in the following based on the attached drawing. Shown are in:

[021] Fig. 1 is a first embodiment of a transmission pursuant to the invention, comprising a countershaft and an input constant;

[022] Fig. 2 is a second embodiment of a transmission pursuant to the invention, comprising a countershaft and two input constants; and

[023] Fig. 3 is a third embodiment of a transmission pursuant to the invention, comprising a downstream arranged area group with a direct connection of the input and output.

[024]

[025] Fig. 1 illustrates a transmission comprising an input shaft 1, an output shaft 2 and a countershaft 3, which comprises a drive constant 4. According to the invention, the gearing of the drive constant 4, arranged on the input shaft 1, is designed such that it can be engaged or disengaged using a shift element 5 so that the countershaft 3 does not rotate in the direct gear. For the purpose of shifting the direct gear, another connecting or shift element 6 is provided, which connects the input shaft 1 to the output shaft 2. Due to this direct connection without the necessity of using a gear wheel, friction losses are further minimized.

[026] Fig. 1 shows additional shift elements 7, 8, which are used for shifting the indirect gears. Within the framework of the embodiment shown in Fig. 1, only the

input shaft 1 and the output shaft 2 rotate in the direct gear so that friction losses are largely avoided.

[027] Fig. 2 illustrates a transmission comprising the countershaft 3 and two drive constants 4, 4'. In such gears, in the direct gear the shift collar 9 between the drive constants 4, 4' is shifted to "neutral"; the gearing of the drive constants 4, 4' is, likewise, designed such that it can be engaged or disengaged using the shift elements 5, 5'.

[028] Fig. 3 shows an area group arranged downstream from the transmission. According to the invention, an input 1' is directly connected to a output 2' of the downstream arranged area group via a shift element 6'; the remaining parts not involved in the power flow are uncoupled according to the invention. For an indirect gear, the shift element 6' is engaged and additional shift elements 10, 11 are disengaged.

Reference numerals

1	input shaft
1'	input shaft of the downstream arranged area group
2	output shaft
2'	output shaft with the downstream arranged area group
3	countershaft
4	drive constant
4'	drive constant
5	shift element
5'	shift element
6	shift element
6'	shift element
7	shift element
8	shift element
9	shift collar
10	shift element
11	shift element